

CHAPTER OVERVIEW

15: Thermodynamics of Chemical Equilibria

Trying to introduce chemical thermodynamics to beginning students is always problematic; to do it "properly" requires a degree of rigor that rarely succeeds for more than a small fraction of the class. Although a full formal development is rarely appropriate at this level, I believe that the value of developing students' understanding of the fundamental concepts is generally underappreciated. This requires some understanding of the ways thermal energy is dispersed in matter— something that is not a part of classical thermodynamics and is not supported by most textbooks, but which is in keeping with the molecular focus of modern chemical science.

The equilibrium value for a reversible reaction is an important quantity that characterizes a chemical reaction, but what factors govern its value? In particular, is there any way that we can predict the value of the equilibrium constant of a reaction solely from information about the products and reactants themselves, without any knowledge at all about the mechanism or other details of the reaction? The answer is yes, and this turns out to be the central purpose of chemical thermodynamics:

The purpose of thermodynamics is to predict the equilibrium composition of a system from the properties of its components.

Don't let the significance of this pass you by; it means that we can say with complete certainty whether or not a given change is possible, and if it is possible, to what extent it will occur— without the need to study the particular reaction in question. To a large extent, this is what makes chemistry a science, rather than a mere cataloging of facts.

[15.1: Energy Spreading Drives Spontaneous Change](#)

[15.2: Entropy Rules](#)

[15.3: The Second Law of Thermodynamics](#)

[15.4: Free Energy and the Gibbs Function](#)

[15.5: Thermodynamics of Mixing and Dilution](#)

[15.6: Free Energy and Equilibrium](#)

[15.7: Some Applications of Entropy and Free Energy](#)

[15.8: Quantum states, Microstates, and Energy spreading in Reactions](#)

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